



Design Economics for the Built Environment

Impact of Sustainability on Project Evaluation

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WILEY Blackwell

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Prof. Thomas Lützkendorf

Thomas Lützkendorf is Chair of Sustainable Management of Housing and Real Estate at the Karlsruhe Institute of Technology (KIT). He is interested in the integration of sustainability issues into decision making processes for the life cycle of buildings, the relationships between buildings' environmental quality and economic advantages. Through long standing co-operation with architects and designers, he is also familiar with the topics and problems concerning the integration of sustainability issues into the design and planning process. He is a member and scientific consultant of the 'roundtable on sustainable building' at the German Federal Ministry of Transport, Building and Urban Affairs. In addition, he is a founding member of the International Initiative for a Sustainable Built Environment (iISBE) and he is actively involved in various standardisation activities at the national, European and international level.

Dr. Shamil Naoum

Shamil Naoum is a Reader at London South Bank University. He received a BSc in Building and Construction Engineering from the University of Technology in Baghdad, an MSc in Construction Management and Economics from the University of Aston in Birmingham, and a PhD in Construction Management from Brunel University in Uxbridge. Before beginning his academic career, he worked in the construction industry as a site engineer and project manager. He is a member of the Chartered Institute of Building and the American Society of Civil Engineers. He has considerable research experience in construction management areas such as procurement methods, site productivity, human resources management and management science. He supervises PhD and postgraduate students researching construction management problems and has published papers in many international conferences and scholarly journals including: *American Society of Civil Engineers* (USA); *International Journal of Project Management* (UK); *Journal of Engineering Construction and Architectural Management* (UK); and *Chartered Institute of Building* (UK).

John Pearson

John Pearson is a Chartered Quantity Surveyor (FRICS) and has spent 36 years working and teaching within the construction industry. During the 1970s and 1980s he worked for Private Practice and for Consultant Civil Engineers, both in the UK and Finland. Since 1987 he has been a principal lecturer at Northumbria University and has held a number of responsibilities including managing Quantity Surveying research. As an active member of the UK Green Party, John is a keen public speaker on the importance of sustainable construction and is very conscious of the need to instil awareness of this in future construction professionals. At Northumbria University, he teaches in a range of subjects and makes every effort to identify the relevance of sustainability. In addition he has supervised both undergraduate and Master's Dissertations in this area. John also has a degree in Law (LLB) and a master's degree in Education (MED).

Prof. Andrea Pelzeter

Andrea Pelzeter studied architecture at the University of Stuttgart in Germany. She worked as an architect in the field of construction and revitalisation. In 2002, she began her postgraduate studies in the field of business administration and real estate at the International Real Estate Business School (IREBS). She started as a research assistant at IREBS and in 2006 pursued her doctoral studies at the European Business School (EBS), International University Schloss Reichartshausen. Her research topic was 'Life-cycle costs of real estate: the influence of location, design and environment'. She founded her consulting agency Pelzeter Lebenszyklus-Management (Lifecycle-Management) in 2006. Since 2007 she has held a Professorship for General Business Administration, particularly Facility Management, at the Department of Cooperative Studies at the Berlin School of Economics and Law (HWR Berlin). She is the author of numerous publications on sustainable development in facilities management and building optimisation with life cycle costing.

Prof. Srinath Perera

Srinath Perera is the Chair and Professor of Construction Economics at Northumbria University, Newcastle upon Tyne. He has over 25 years' experience working as a consultant Quantity Surveyor, Project Manager and lecturer. He is a chartered surveyor and a member of both the Royal Institution of Chartered Surveyors and the Australian Institute of Quantity Surveyors. He presently leads the Construction Economics and Management Research group at the Faculty of Engineering & Environment of Northumbria University. His main research interests are in the broad field of Construction Economics covering, risk and value management, cost planning and management, innovation management; sustainability: whole life costing, cost-benefit analysis, carbon estimating; e-business: ICT in construction, e-procurement, decision support and knowledge based systems; professional education. He is currently a coordinator of the e-Business in Construction, task group TG83 of the CIB.

David Picken

David Picken is a Fellow of the Royal Institution of Chartered Surveyors and the Australian Institute of Quantity Surveyors. After university David worked as a volunteer on an aid project in Papua New Guinea. He joined a firm of consultant quantity surveyors in Adelaide in 1973, and held similar positions in the UK and Saudi Arabia. His academic career began at The Hong Kong Polytechnic University in 1979. He completed a research Masters at the University of Salford in life cycle costing in 1989, and studied value engineering practices during a placement with the Hanscomb Group in the USA in 1994. From 1995 to 2009, he taught at the School of Architecture and Building at Deakin University (Australia). His publications include textbooks for measurement practice and papers on design and construction economics in international refereed journals. His teaching was recognised by awards for excellence and outstanding achievement. He is now an adjunct teaching fellow at Bond University in Queensland. David's research interests focus on design economics, procurement and risk management.

Richard Powell

Richard Powell is a Senior Cost Manager with Turner & Townsend Cost Management, a leading international construction consultancy company. He chose quantity surveying as a career as he was attracted to having the on-site experience.

Richard successfully achieved a first-class honours degree in the Quantity Surveying Consultancy course at Kingston University. For the early part of his career Richard was mainly involved within the public sector supporting projects from school extensions to health centres. He then rose to the challenge on the prestigious Heathrow Terminal 5 project for 2 years prior to playing a key role within the cost management of a food retail account. As a chartered surveyor, he now leads the commercial management for a major retail banking client on the refurbishment of their branch network. Richard is passionate about first-class service delivery and passing his knowledge onto those undertaking their RICS APC.

Prof. David Proverbs

David Proverbs is Professor of Construction Management and presently Head of the Department of Architecture and the Built Environment and co-Director of the Centre for Floods, Communities and Resilience at the University of the West of England, Bristol. He is Chair of the Council of Heads of the Built Environment (CHOBE) in the UK, a member of the CIOB Educational Committee and a member of the RICS UK Education Standards Board. He has undertaken numerous research projects, both for industry and the government. Research funding has been secured from the research councils, and various public and private sponsors. Areas of research specialism within flood risk management issues include adaptation to flood risk, damage assessment, flood repair and flood resilience. He is Co-Editor of the *Structural Survey: Journal of Building Pathology and Refurbishment*; and the *International Journal of Sustainable Development and Planning*.

Jon Scott

Jon Scott is a Senior Cost Manager at Bruce Shaw, a multidisciplinary consultancy with both UK and international offices. Jon is a chartered surveyor; originally an Economics graduate with an MSc in Quantity Surveying. He has over 10 years' experience across a number of private firms including Cyril Sweett – a leading international construction consultancy. His experience includes a variety of sectors including residential, commercial, retail and PPP sectors, both in the UK and France. This experience includes the responsibility for cost planning from the inception of many different projects. He is currently working on a number of high specification residential projects in both London and Paris with Bruce Shaw. Jon has previously undertaken published research on Operational Private Finance Initiative projects and the payment mechanism.

Dr. Ian Selby

Ian Selby graduated from the University of Wales Aberystwyth in 1990 with a BSc (Econ.) Hons in International Politics. He then read an MPhil (1992) and PhD at University of Cambridge (1998). During the 1990s he worked for various public and private sector organisations developing research and public affairs activities, and led a research and marketing department for a major UK media organisation between 1998 and 2000. In 2000, he took up his first post in the built environment sector at the British Council for Offices, where he was responsible for establishing the research and public affairs department, which he subsequently led between 2002 and 2008 as Director of Research & Public Policy. He is currently the Research Director at The College of Estate Management. He has managed major research projects on flooding, and grey water usage in the UK housing sector. He has been a member of HMG committees, including the ODPM's Working Party on Decontamination of

Buildings, the DCLG's Working Party on Building Regulations and Energy Performance Certificates Advisory Implementation Committee. Ian is also currently an adviser to the CRS in Wales, and to the *Ústí Nad Labem-Libouchec Green Community Investment Project* in the Czech Republic.

John Symes-Thompson

John Symes-Thompson has built up over 30 years of experience in the commercial property investment markets, including 11 years at ING Real Estate in a fund management role, and 3 years at CBRE in investment agency. He joined CBRE in October 2005 as a Senior Director in the Capital Markets Division, but moved over to the Investment Valuation team in 2008 where he is able to bring his market experience and knowledge to the table for key institutional clients. He is currently the lead valuer for Standard Life Assurance, UBS Global Asset Management, BAE Systems Pension Trustees, Royal Bank of Scotland Pension Fund, Lothian Pension Fund, Mountgrange and Santander Pension Trustees in the UK. On the corporate side his clients include Sports Direct, BHS plc. and Arcadia Group. He has a specialist knowledge and interest in sustainability issues and is a member of the IPD ECOPAS Steering Group and the RICS Valuation Working Group on Sustainability.

Dr. Chika Udejaja

Chika Udejaja graduated as a Civil Engineer and worked briefly as a site engineer and design engineer before undertaking postgraduate studies in Concrete Structures at Imperial College London. This was followed by a brief assignment as a bridge engineer in Malaysia before he returned to the UK, to undertake a PhD in Construction Management at the London South Bank University. On completion of his PhD in 2003, he joined the University of Newcastle as a researcher, and was involved in developing CAPRIKON and other research projects. He is currently a senior lecturer in the Faculty of Engineering and Environment at Northumbria University. He teaches procurement, technology, and sustainability to future generations. His main research interests are in construction management and information technology. More recently, he has become increasingly involved in innovative product and process management looking at how modern construction management techniques and sustainable technologies can be used to deliver government and industry targets on improving efficiency and reducing carbon emissions.

Paul Ullmer

Paul Ullmer is a Quantity Surveyor with EC Harris, a leading international built asset consultancy company which is part of ARCADIS, a leading global engineering and consultancy firm, providing consultancy, design, engineering and management services.

Prof. J.W.F. Hans Wamelink

J.W.F. Hans Wamelink has been the Professor of Design and Construction Management in the Faculty of Architecture and the Built Environment, Department of Real Estate and Housing, Delft University of Technology since April 2006. The educational and research activities of his Chair intend to empower professionals and organisations in the AEC industry with new processes and business models which integrate knowledge, organisations and procurement to deliver innovative building projects, and the sustainable renewal of the built environment. The Chair

takes care of the education in the bachelor degree as well as in the master's degree programmes. Apart from his role as a professor, he was owner–director of Infocus and a consultant at DHV, both companies specialised in consultancy and building management. After finishing his PhD at the Delft University of Technology he worked for 10 years as an Assistant Professor at the Faculty of Technology Management of the Eindhoven University of Technology in the Netherlands.

Dr. Lei Zhou

Lei Zhou is a lecturer in Construction Economics at the Faculty of Engineering and Environment, Northumbria University, UK. He is a columnist for *International Journal of Project Contracting & Labour Service*. He graduated from Heriot-Watt University with an honours degree in Building Economics and Quantity Surveying. He obtained an MPhil degree in sustainable construction from the University of Manchester. He further gained a PhD degree from Oxford Brookes University in the UK in 2009. He has expertise in Project Finance and Investment, Low Carbon City and Sustainable Construction, Quantity Surveying, Construction E-business and Public Project Management and Auditing.

Foreword

With continuing pressure and innovation in the built environment of today, and with more people now living in cities than in the history of mankind, getting that environment to be an exciting, vibrant, sustainable and cost effective place for communities, occupiers, as well as clients, has never been more important. Understanding design economics is critical to help deliver this vision around the globe, and to enable qualified professionals to provide effective and well considered advice in land, property and construction.

In *Design Economics for the Built Environment*, the Editors, Professor Herbert Robinson, Barry Symonds, Professor Barry Gilbertson and Professor Benedict Ilozor, are unquestionably well recognised professionals in providing such advice around the world. They, together with an expert team of academics and practitioners, bring the theory and practice alive for the reader. Collectively, they are to be congratulated on what has been a challenging task to pull together the latest thinking in such a well informed and coherent way. This is a hugely credible book, providing evidence of the importance of striking the right balance between theories and practices leading to a relevant and robust built environment of the future. It is incredibly well structured and thought through, as you would expect with such a prestigious roll call of academics and practitioners on the contributor list:

- In Part I, all the key elements necessary for effective design economics from an up-to-date view on the theories, principles, concepts and approaches to design economics. Important developments such as the new rules of measurement, new processes for productivity and efficiency, innovation and technologies including BIM, whole life sustainable costing, fiscal policies and incentives for achieving sustainability in design, effective procurement and sustainability tools (including BREEAM and LEED), sustainable communities, flooding risks and cost of mitigation all feature with many of the world's academic experts sharing their words of wisdom.
- Part II makes the theory come alive through practitioners sharing their experience through industry perspectives, practical examples and case studies. Key elements from Part I are unpacked to reinforce the theories and principles

learned and the implications of delivering value for money alongside the need to balance environmental, economic and social pressures of today's construction industry.

So wherever you are in the world, this is a lively and refreshing up-to-date view of design economics in terms of acting as a core enabler for delivering sustainable buildings and infrastructure projects. Whether you are currently studying for a related degree, are a practitioner or influencer in the field, this book will have something for you. I only wish something so well considered that conjoins the latest academic thinking with the practicalities of the built environment were available when I was studying.

It is a huge privilege to be asked to write the foreword for this book, with so many of those I have known in the industry involved in editing or contributing. All I can say is that it has to be worth a read. Design economics is the only thing that can influence the future of the built environment and with countries like India set to build the equivalent of a Chicago every year for the next 26 years, getting this right now is paramount for creating the best environment possible for the generations to come. If you are set to read this book you do so I am sure as a potential key contributor to the built environment now or for the future – there is no question this book will set you up with the latest thinking you require.

Amanda Clack

MSc BSc FRICS FAPM FIMC CMC Affiliate ICAEW
Vice President of the Royal Institution of Chartered Surveyors and
Partner at PricewaterhouseCoopers

Preface

The drive towards low carbon economy, zero carbon buildings and environmentally friendly infrastructure means that there is a growing interest to design in a way that reflects sustainability principles of balancing economic, social and environmental factors. Design economists are increasingly called upon to respond to new and complex challenges by providing solutions that deliver value for money for clients within the constraints of balancing the environmental, economic and social factors in the development process. The unifying theme throughout the book is therefore how to respond to the increasing social, economic and environmental pressure as a result of changes in regulations and clients' priorities to address emerging challenges in the built environment. Previous books on design economics are either too out-dated, or narrowly focused, on exploring the relationship between fundamental design variables relating to geometry in terms of size, shape, arrangement, height and their effects on capital costs. There have been a number of significant books written on the subject over the past decades. The *Economics of Building* by Herbert W. Robinson published in 1939 was the first book to be devoted entirely to the economic aspects of building. This book was a condensation of the author's PhD thesis written at the London School of Economics and was followed by other significant publications including Ivor Seeley's popular book on *Building Economics* in 1972.

However, it is now recognised that design economics should focus on a wide range of issues affecting construction costs and value from a user, buyer or tenant perspective within a changing policy environment and regulatory framework. This book presents new directions and perspectives reflecting the need to recognise the importance of climate change and sustainability in project design. Considerable attention is therefore given to design factors influencing sustainability and environmental externalities, life cycles of buildings with carbon emission treated as external costs, productivity and efficiency, taxation, monetary and fiscal policies, and other fiscal incentives (e.g. levies, reliefs and capital allowances), affect design and construction costs. Attention is also devoted to emerging issues such as the development of assessment frameworks to reduce the environmental costs of design, flooding risks and mitigation, cost implications of terrorism and similar explosive threats, new processes, innovation and technologies such as

Building Information Modelling, knowledge management systems, role of education and their impact on improving productivity and efficiency of the design process to reduce both project duration and costs.

This book explores the theories, principles of design economics and how it is applied in the construction industry. It is carefully structured into two parts. Part I provides the context and discusses key theories and principles of design economics. Part II focuses on the application of the theories, principles and approaches in Part I by presenting practical examples, case studies as well as tools and frameworks used to achieve creativity resulting in sustainable design outcomes. This approach of integrating theory and principles with practice, tools and case studies provides a better understanding of the linkages between theories and principles of design economics to industry practices leading to a greater appreciation of the discipline of design economics and its increasingly important role in addressing critical economic, social and environmental challenges faced by clients of the construction industry today.

As editors, it has been a long and challenging process but a rewarding journey to put a book of this nature and complexity together. We want to take this opportunity to register our deepest appreciation to all the contributors from academia and industry. We also recognise that the book we are producing is at a time when there are unprecedented changes in the construction industry. The blend of invaluable contribution from academia and industry has made this book unique in many ways. The principles, industry case studies and practical tools incorporated are useful for final year and postgraduate students in design and architecture, construction management, facilities management, quantity surveying, engineering and project management, as well as government policy makers, consultants, contractors and advisers to client organisations. The book will enable both students and practitioners to explore and understand the multiplicity of factors that contribute to efficient design which can reduce both the capital and operating costs of buildings and infrastructure projects and minimise the environmental and social costs to society. Finally, we want to thank Madeleine Metcalfe and her team of editorial assistants and publishers at Wiley-Blackwell for their encouragement and patience in putting this book together.

Editors' and Publishers' Acknowledgement

We are grateful to Rapid 5D/Trimble for their generous support towards the colour illustrations in this book.